

## Alternative Theories of the Origin of Derived Stimulus Relations

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Two theories of derived stimulus relations are discussed. Sidman's primary process theory holds that contingencies establish the discriminative stimulus, the response, and the reinforcement as members of the same equivalence class. This position suggests a continuity of processes between humans and nonhumans and requires only a very modest change in traditional views concerning principles of behavior. Hayes, Barnes-Holmes and Roche also maintain that equivalence is a function of contingencies. However, they maintain that equivalence is only one of many relational frames that are developed through learning multiple examples. Moreover, once relational frames are developed, these frames may change the effects of direct contingencies. They state that if their position is valid "we must rethink all of behavioral psychology as it applies to verbal organisms." Their position implies a discontinuity between the behavior of humans and nonhumans. These two different perspectives suggest quite different research agendas. The research agenda suggested by Hayes et al. is primarily directed toward the study of human behavior, while the research agenda of Sidman suggests the study of both human and nonhuman behavior.

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It has been my privilege to read two very stimulating discussions of derived stimulus relations during the past two years. While neither discussion presents an essentially new position, both involve elaboration and clarification of earlier positions that should provide a basis for fruitful research. The two discussions are Sidman's article *Equivalence Relations and the Reinforcement Contingency* (Sidman, 2000) and *Relational Frame Theory: A Post-Skinnerian Account of Language and Cognition* (Hayes, Barnes-Holmes, & Roche, 2001). Both discussions place major emphasis on contingencies as the basis for derived relations.

Sidman's position is that contingencies of reinforcement result in two outcomes: analytic and equivalence. Sidman maintains that during conditioning, the discriminative stimulus, the response, and the reinforcer all become members of an equivalence class. That is, contingencies result in equivalence. However, in the typical matching to sample experiment, the same response is required to each comparison stimulus and the same reinforcer is delivered for each correct stimulus selection. Such conditioning results in the equivalence process for the response and reinforcement being overrid-

den by the analytic function of the contingencies. Otherwise, no conditional discrimination would occur, because the equivalence function would result in all stimuli becoming members of the same class. Since equivalence is assumed to occur naturally as a fundamental property of contingencies, Sidman maintains his original position that equivalence is a basic process, just as are reinforcement, discrimination, and extinction.

Like Sidman, Hayes and colleagues maintain that equivalence is a function of contingencies. However, for these authors the contingencies that generate equivalence are the reinforcement of many examples in which the frames of equivalence hold. For Hayes and colleagues, equivalence is one of many relational frames learned as the result of training with multiple examples. In short, for Sidman equivalence is a basic and direct outcome of contingencies, while for Hayes and colleagues equivalence is a learned relation. Both models "lay out a vibrant research agenda" which for Hayes and colleagues is a major criterion for evaluating a model. However, the research agendas implied by the two models are very different. Sidman proposes a series of research studies which holds the possibility of clarifying the fundamental processes of conditioning. The studies that are suggested would involve both humans and nonhumans. Sidman's model suggests a continuity of nonhuman and human behavioral processes, and a continuity between traditional behavior analysis principles and his

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current conception of equivalence. Sidman seems to view his model as evolutionary. He specifically states that no new concepts are required (Sidman 2000, p. 145). The only change that is required is the acknowledgment that contingencies can establish a class that includes the stimulus, response, and reinforcement. The Hayes and colleagues model suggests the likelihood of discontinuity both with regard to nonhuman and human behavioral processes and between the relational frame conceptualization and traditional behavioral conceptions. In fact, Hayes and colleagues seem to view their model as revolutionary when they say "If Relational Frame Theory is valid we must rethink all of behavioral psychology as it applies to verbal organisms" (Hayes et al, 2001, p. 153) The research suggested involves human subjects almost exclusively.

### *Relational Frame Theory*

By alluding to Sidman's 2000 article, I have digressed from my original assignment, which was to review the Hayes, Barnes-Holmes and Roche book, *Relational frame Theory: A Post Skinnerian Account of Human Learning and Cognition*. I will return to that task now, but I will again have comments on the relationship between the model presented by Sidman and the model presented in the Hayes et al. book.

For an edited book, *Relational Frame Theory: A Post-Skinnerian Account of Human Language and Cognition* is exemplary. It is far more coherent than most edited volumes. Each chapter relates to earlier and subsequent chapters in such a way that the book forms a consistent and coherent presentation of relational frame theory and its implications for development of complex human behavior. Although the chapters were often written by different sets of authors, two of the editors (Hayes and Barnes-Holmes) are both co-authors of 11 of the 13 chapters. On the remaining two chapters either Hayes or Barnes-Holmes is a co-author. Thus, every chapter has the imprint of the two first authors. However, by presenting the authors of each chapter, the editors have given appropriate credit to their colleagues and students who participated in writing the chapters.

The current book, like *Verbal Behavior* (Skinner, 1957) attempts to interpret or explain very complex human behavior based on prin-

ciples formulated on the basis of laboratory research. For Skinner, the body of research was derived almost exclusively from experiments with rats and pigeons. For Hayes, Barnes-Holmes, and Roche, the body of research is largely derived from studies of humans. While some of the experiments involved people with limited verbal skills, many of the studies involve college students or other persons with highly developed verbal repertoires. Hayes and colleagues acknowledge that Skinner's basic conceptualization in terms of the three-term contingency has greatly advanced our understanding of the variables that influence human behavior. However, they maintain that Skinner's definition of verbal behavior was fundamentally flawed. According to Hayes and colleagues, Skinner defined the behavior of the speaker as verbal based on the conditioning history of the listener. That is, verbal behavior is behavior reinforced through the mediation of another person who has been conditioned by the community to reinforce behavior in a specific way. If verbal behavior is defined in terms of the listener, then an experimental analysis would begin with a study of the conditions controlling listener behavior, rather than the conditions controlling the speakers behavior. Moreover, the authors criticize Skinner for treating listener behavior as simple discriminative behavior. The Hayes et al formulation maintains that the listener as well as the speaker is engaging in verbal behavior.

The authors propose that two areas of research, not available to Skinner in 1957, suggest a new conceptualization relevant to language and cognition. Those areas are research on rule-governed behavior and derived-stimulus relations. Research on rule-governed behavior demonstrated that instruction to a listener affected a person's response to contingencies, and that instructions could even override direct contingencies. However, the area of research that lay the basis for relational frame theory is research demonstrating derived relational responding. The prototype of relational framing is stimulus equivalence as defined by Sidman and colleagues (Sidman et al., 1982; Sidman & Tailby, 1982). Sidman and colleagues defined an equivalence relation as a relation which had the properties of reflexivity, symmetry, and transitivity. Experimentally these properties were demonstrated in a match to sample experiment in which subjects were

given training on an A–B and an A–C conditional discrimination and then performed “correctly” on: (1) reflexivity tests A–A, B–B, C–C; (2) symmetry tests B–A, C–B; and (3) transitivity tests A–C. According to Sidman if these tests were all positive then the C–A combined symmetry and transitivity test would, by necessity, be positive.

For Hayes and colleagues, while equivalence is an example of a relational frame, they maintain that there are many other relational frames. They propose a general definition of a relational frame that parallels Sidman and colleagues’ definition of equivalence. A relational frame is defined in terms of three qualities: mutual entailment, combinatory entailment, and transformation of function. Symmetry is a specific example mutual entailment. If A equals B, then B equals A. However, *mutual entailment* is also involved in other relational frames such as bigger than and smaller than, faster than and slower than, later than and earlier than, cause of and effect of and opposite. In each of these cases the first statement mutually entails the second. If A is bigger than B, then B must be smaller than A. If A is opposite of B, then B must be opposite of A. Transitivity is an example of *combinatory entailment*. If A equals B and B equals C, then A must equal C. But combinatory entailment also holds that if A is more than B and B is more than C, then A is more than C. Furthermore if mutual entailment also holds, then if A is more than B and B is more than C, then B is less than A and C is less than B and C is less than A. Or if A is opposite of B and B is opposite of C then A must be the same as C. Now *transformation of function* holds that if stimulus A has a particular function, the functions of other stimuli will be transformed in accordance with the relational frame. For example in the frame of opposition, if A is opposite of B and B is opposite of C, then A and C are the same, and if A functions as a punisher, B will be neutral or function as a positive reinforcer, while C functions as a punisher. For Hayes and colleagues, relational framing is verbal behavior and both speakers and listeners frame events.

Any stimulus may function in a number of relational frames depending on context or other conditional stimuli. For example, an apple and a cherry may participate in an equivalence frame if the context is fruit, or they may participate in a larger than or smaller than frame

if the context is size. For Hayes and colleagues, such a conception allows for the development of large networks of relational frames which allow for an interpretation of such complex verbal phenomena as analogies, metaphors, and stories.

The title of the book is *Relational Frame Theory: A Post-Skinnerian Account of Language and Cognition*. That title suggests that while the account has its roots in Skinner’s work, it progresses beyond Skinner’s work. Now, what are the roots found in Skinner’s work? First, Skinner considered verbal behavior important enough to devote a book to interpreting verbal behavior in a naturalistic system. Hayes et al. also consider interpreting verbal behavior in a naturalistic system. Second, Skinner considered contingencies important in analysis of verbal behavior. Hayes et al. also consider contingencies important. Third, Skinner defined the operant functionally. Hayes et al. also define the operant functionally. How is the Hayes et al. book post Skinnerian? First, insofar as both speakers and listeners engage in relational framing, both are engaged in verbal behavior. Such equality of speaker and listener behavior seems to more readily account for the type of communication that occurs between speakers and listeners and writers and readers than did Skinner’s system, which during the initial chapters focused almost entirely on the speaker. Second, the Hayes et al. book holds that verbal behavior can have powerful effects on speakers or listeners. Once a system of relational frames is conditioned, the effects of direct contingencies are modified. In some cases the relational frames result in acting in direct contradiction to the non-verbal contingencies. The Hayes et al. model appears to make many initially perplexing behavioral phenomena more understandable. For example, if verbal behavior can result in behavior that defies contingencies, then the acts of suicide bombers who are promised reward in heaven seem more understandable.

## CONCLUSIONS

I started this review with admiration for both Sidman’s 2000 article and the current book. I still maintain that admiration for both manuscripts. Both manuscripts attempt to address what appears to be a large conceptual gap between the demonstrations of derived stimulus

relations and the traditional behavior analytic account based on the three-term contingency. That gap is manifest in at least two ways. First, traditional three-term contingency analysis focuses on the independence of behavioral repertoires. Work on derived stimulus relations has focused on the interrelation of repertoires. The basis for the traditional three-term contingency analysis of behavior has been primarily derived from studies with nonhuman animals. The demonstrations of derived stimulus relations have been based primarily on research with humans. Sidman attempted to bridge this gap by maintaining that equivalence is a basic outcome of contingencies. His article lays out a series of experiments designed to test this hypothesis. The suggested research would promote a line of research that would maintain a continuity between human and nonhuman research with the possibility that such basic research would eventually lead to an understanding of complex human symbolic behavior. However, the research proposed still seems quite remote from the complexity of human language and cognition. Nevertheless, the attempt to extend basic principles to close the gap between the traditional three-term contingency accounts and the facts concerning derived stimulus relations is very appealing.

Hayes and colleagues also attempt to close the gap between traditional accounts and the facts concerning derived-stimulus relations. They attempt to bridge the gap by forwarding the concept of an overarching operant which is produced by multiple exemplar training. They maintain that the concept of the overarching operant is merely an extension of Skinner's functional definition of the operant. Relational frames are merely overarching operants that may take an indefinite number of forms. Relational frame theory suggests a direct attack on the issues of verbal behavior by studying human verbal behavior. To date, the research has been largely aimed at demonstrating relational framing among individuals with normal or near normal verbal repertoires. Clearly, their research demonstrates that human adults and verbal children do exhibit the behaviors that they define as relational frames. However, while their multiple-exemplar hypothesis is plausible and appealing, they still have to demonstrate that such relational framing can be established through multiple exem-

plar training. In short, there is a question concerning whether relational frames form the basis for language and cognition or whether relational frames is simply the manifestation of a mature language system acquired through some other mechanism. Although the authors acknowledge that the evidence that relational framing is learned through multiple examples is limited, they argue that research on other overarching operants (generalized imitation, identity matching, and unreinforced conditional selection) strongly suggests the possibility that relational framing is an overarching operant formed by training with multiple examples. Relational frame theory presents a plausible hypothesis, which if true, has important implications for education and treatment of behavioral disorders.

In summary, *Relational Frame Theory: A Post-Skinnerian Account of Language and Cognition* is a serious and reasonable attempt to account for the wide diversity of human symbolic behavior. I found the arguments stimulating and somewhat compelling. I strongly recommend it to those interested in the study of verbal behavior.

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